Notice No.4

Rules and Regulations for the Classification of Special Service Craft July 2016

The status of this Rule set is amended as shown and is now to be read in conjunction with this and prior Notices. Any corrigenda included in the Notice are effective immediately.

Issue date: December 2016

Amendments to	Effective date	Mandatory Instrument
Part 10, Chapter 1, Section 2	1 January 2017	
Part 11, Chapter 2, Sections 3 & 7	1 January 2017	X
Part 13, Chapter 1, Section 3	1 January 2017	
Part 15, Chapter 1, Sections 3, & 11	1 January 2017	
Part 15, Chapter 1, Sections 5, & 13	1 January 2017	X
Part 15, Chapter 2, Section 11	1 January 2017	X
Part 15, Chapter 3, Section 13	1 January 2017	X
Part 16, Chapter 2, Section 9	1 January 2017	

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Part 10, Chapter 1
Reciprocating Internal Combustion Engines

■ *Section 2*
Materials and Components

2.2 Test and inspections

(*Part only shown*)
Table 1.2.1 Summary of documentation and testing for engine components

Part	Material properties *see* Note 2	Non-destructive examination	Hydraulic testing *see Pt 10, Ch 1, 2.3 Hydraulic Tests 2.3.1*	Dimensional inspection *see* Note 3	Visual inspection	Applicable to engines	LR Component Certification *see* Note 4
Accumulator of common rail fuel or servo oil system *see* Note 14	C + M	-	~~P~~ Lesser of 1,5*p* or *p*+300 bar	-	-	Accumulators with a capacity >0,5l	-

2.5 Autofrettage

2.5.1 Manufacturers, and external providers of products or services, who carry out autofrettage of engine components, are to apply an approach for product assurance that is ~~approved~~ accepted by LR.

2.5.3 Testing carried out as part of the approach for product assurance is to confirm that the autofrettage process has not detrimentally affected the components and demonstrate that the prescriptive ~~rule~~ Rule requirements for pressure containment have been met, *see Table 1.2.1 Summary of documentation and testing for engine components*.

Part 11, Chapter 2
Shafting systems

■ *Section 3*
Materials

3.1 Materials for shafts

3.1.5 Where materials with greater specified or actual tensile strengths than the limitations given above are used, reduced shaft dimensions or higher permissible vibration stresses are not acceptable when derived from the formulae used in sub-Sections *Pt 11, Ch 2, 4.2 Intermediate shafts, Pt 11, Ch 2, 4.4 Screwshafts and tube shafts, Pt 11, Ch 2, 4.5 Hollow shafts* and *Pt 13, Ch 1, 3.2 Limiting stress in propulsion shafting* unless, for intermediate shafts only, it is verified that the materials exhibit a similar fatigue life to conventional steels through compliance with the requirements in *Pt 11, Ch 2, 7 Approval of alloy steel used for intermediate shaft material*.

■ *Section 7*
Approval of alloy steel used for intermediate shaft material

7.1 Application

7.1.1 The requirements of *Section 7 Approval of alloy steel used for intermediate shaft material* are, in addition to the requirements of the *Rules for the Manufacture, Testing and Certification of Materials*, *Ch 5*, *3 Forgings for shafting and machinery*, to be applied to the approval of alloy steel which has a minimum specified tensile strength greater than 800 N/mm^2, but, not exceeding 950 N/mm^2 intended for use as intermediate shaft material.

7.2 Torsional fatigue test

7.2.1 A torsional fatigue test is to be performed to verify that the material exhibits a similar fatigue life to conventional steels. The torsional fatigue strength of the material is to be equal to or greater than the permissible torsional vibration stress τ_c given by the formulae in *Pt 13, Ch 1, 3.2 Limiting stress in propulsion shafting*.

7.2.2 The test is to be carried out with notched and unnotched specimens respectively. For calculation of the stress concentration factor of the notched specimen, fatigue strength reduction factor β should be evaluated in consideration of the severest torsional stress concentration factor in the design criteria.

7.2.3 Test procedures are to be in accordance with Section 10 of ISO 1352 and the test conditions applied are to be in accordance with *Table 2.7.1 Test condition*. Mean surface roughness is to be less than 0,2μm Ra with the absence of localised machining marks verified by visual examination at low magnification (x20) as required by Section 8.4 of ISO 1352.

Table 2.7.1 Test Condition

Loading type	Torsion
Stress ratio	*R* = -1
Load waveform	Constant amplitude sinusoidal
Evaluation	S-N curve
Number of cycles for test termination	1 x 10^7

7.2.4 The measured torsional fatigue strength for continuous operation, τ_c, and torsional fatigue strength for transient operation, τ_t, are to be equal to or greater than the values given by the following formulae:

$$\tau_{c \geq \frac{\sigma_u + 160}{6}} . C_k . C_d \text{ for } r = 0$$

$$\tau_{t \geq 1.7 . \tau_c . \frac{1}{\sqrt{C_k}}}$$

Where
C_k = a factor for different shaft design features, *see Table 1.3.1 C_k factors, Pt 13, Ch 1, 3.1 Symbols and definitions 3.1.4*
C_d = size factor, *see Pt 13, Ch 1, 3.1 Symbols and definitions, 3.1.1*
σ_u = specified minimum tensile strength of the shaft material, in N/mm^2
r = speed ratio, N/N_s, *see Pt 13, Ch 1, 3.1 Symbols and definitions, 3.1.1*

7.3 Material requirements

7.3.1 The steels are to have a degree of cleanliness as shown in *Table 2.7.2 Cleanliness requirements* when tested according to ISO 4967 method A. Representative samples are to be obtained from each heat of forged or rolled products.

Table 2.7.2 Cleanliness requirements

Inclusion group	Series	Limiting chart diagram index I
Type A	Fine	1
	Thick	1
Type B	Fine	1,5
	Thick	1
Type C	Fine	1
	Thick	1
Type D	Fine	1
	Thick	1
Type DS	-	1

Part 13, Chapter 1
Torsional Vibration

■ *Section 3*
Design

3.2 Limiting stress in propulsion shafting

3.2.4 In general, the tensile strength of the steel used is to comply with the requirements of *Pt 11, Ch 2 Shafting systems*. For the calculation of the permissible limits of stresses due to torsional vibration, σ_u is not to be taken as more than 800 N/mm^2 in the case of intermediate shafts and 600 N/mm^2 in the case of thrust and propeller shafts unless, for intermediate shafts only, it is verified that the materials exhibit a similar fatigue life to conventional steels through compliance with the requirements in *Pt 11, Ch 2, 7 Approval of alloy steel used for intermediate shaft material*.

Part 15, Chapter 1
Piping Design Requirements

■ *Section 3*
~~Class of pipes~~ Classes of piping systems and components

3.1 General

3.1.1 ~~Pipework~~ Pressure piping systems are divided into three classes ~~depending on the internal fluid and design temperature and pressure of the system~~for the purpose of assigning appropriate testing requirements, types of joints to be adopted, heat treatment and weld procedure.

~~3.1.2 Material test requirements for the different classes of pipe are detailed in the *Rules for the Manufacture, Testing and Certification of Materials* (hereinafter referred to as the Rules for Materials).~~

~~3.1.3 Acceptable jointing methods for the different classes of pipe are given in the appropriate Section of this Chapter. Material certificate requirements are given in *Pt 15, Ch 1, 11 Material certificates*.~~

~~3.1.4 The maximum design pressure and temperature for Class II and III systems is given in *Table 1.3.1 Maximum pressure and temperature conditions for Class II and III piping systems*. To illustrate, *see Figure 1.3.1 Classes of piping system*.~~

~~3.1.5 Class I pipes are to be used where either the maximum design pressure or design temperature exceeds that applicable to Class II pipes.~~

3.1.2 Dependent on the service for which they are intended, Class II and III pipes are not to be used for design pressure or temperature conditions in excess of those shown in *Table 1.3.1 Maximum pressure and temperature conditions for Class II and III piping systems*. Where either the maximum design pressure or temperature exceeds that applicable to Class II pipes, Class I pipes are to be used. To illustrate this, *see Figure 1.3.1 Classes of piping systems*.

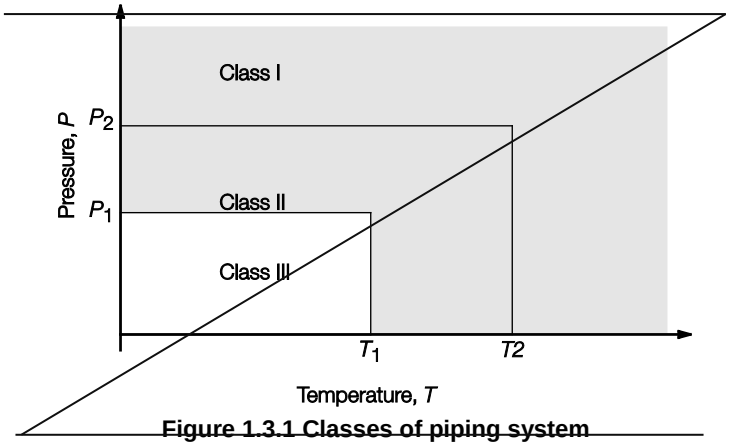
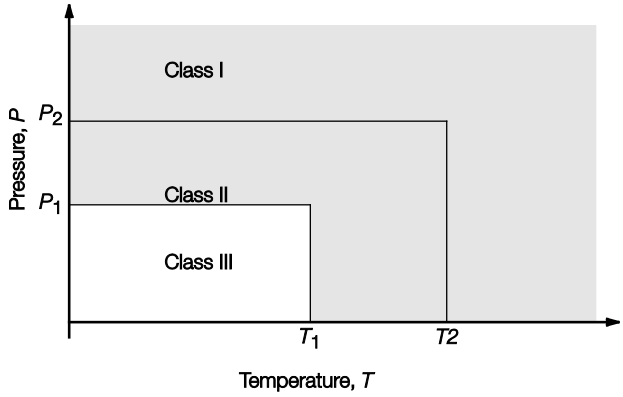


Figure 1.3.1 Classes of piping system



NOTE
T_1 and P_1 correspond to the maximum temperatures and pressures for a Class III piping system and T_2 and P_2 to those for a Class II piping system depending on the service.

Figure 1.3.1 Classes of piping system

Table 1.3.1 Maximum pressure and temperature conditions for Class II and III piping systems

Piping system	Class II		Class III	
	~~p~~ P_2	T_2	~~p~~P_1	T_1
	bar	°C	bar	°C
Steam	16,0	300	7,0	170
Thermal oil	16,0	300	7,0	150
Flammable liquids, ~~(~~*see* Note 1~~)~~	16,0	150	7,0	60
Other media, *see* Note 2	40,0	300	16,0	200

Note 1 Flammable liquids include: fuel oil, ~~thermal oil and~~ lubricating oil and flammable hydraulic oil.
Note 2 Including water, air, gases, non-flammable hydraulic oil.

~~3.1.6~~ 3.1.3 In addition to the pressure piping systems in *Table 1.3.1 Maximum pressure and temperature conditions for Class II and Class III piping systems*, Class III pipes may also be used for open-ended piping, e.g. overflows, vents, boiler waste steam pipes, open ended drains, sounding pipes, etc.

3.1.4 Class II and III pipes are not to be used for toxic media.

3.1.5 Class I pipes are generally required for corrosive media. Class II pipes may be used for corrosive media where special safeguards for reducing the potential for leakage and limiting its consequences are provided, e.g. the use of pipe ducts, shielding, screening, etc. in such a way that a leakage will not cause a potential hazard or damage to surrounding areas. Class III pipes are not to be used for corrosive media. Materials used for piping for corrosive media are to be specially considered.

3.1.6 For piping systems or components using cast iron, *see Pt 15, Ch 1,* 7 *Cast iron*.

■ *Section 5*
Carbon and low alloy steels

5.2 Steel pipe joints

5.2.7 Piping with joints is to be adequately adjusted, aligned and supported. Supports or hangers are not to be used to force alignment of piping at the point of connection.

5.8 Other mechanical couplings

5.8.1 Pipe unions, compression couplings, or slip-on joints, as shown in *Figure 1.5.2 Examples of mechanical joints (Part 1)* and ~~*Pt 15, Ch 1, 5.8 Other mechanical couplings 5.8.11*~~*Figure 1.5.3 Examples of mechanical joints (Part 2)*, may be used if ~~type approved~~ Type Approved for the service conditions and the intended application. The ~~type approval~~ Type Approval is to be based on the results of testing of the actual joints. The acceptable use for each service is indicated in *Table 1.5.6 Application of mechanical joints* and dependence upon the Class of piping, with limiting pipe dimensions, is indicated in *Table 1.5.7 Application of mechanical joints depending on class of piping*.

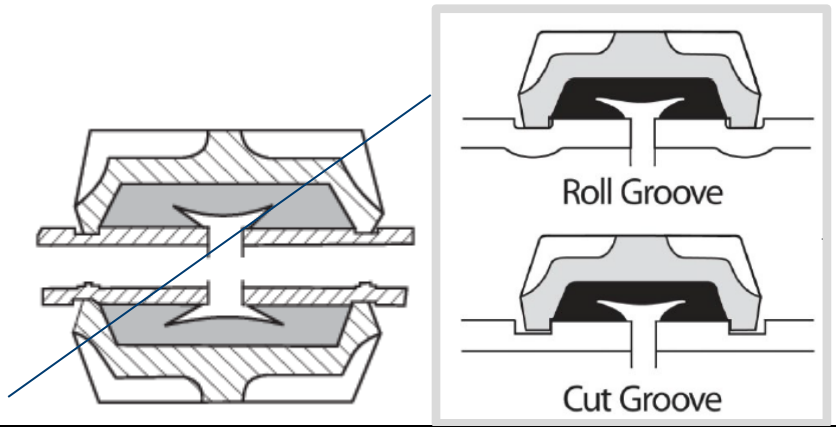
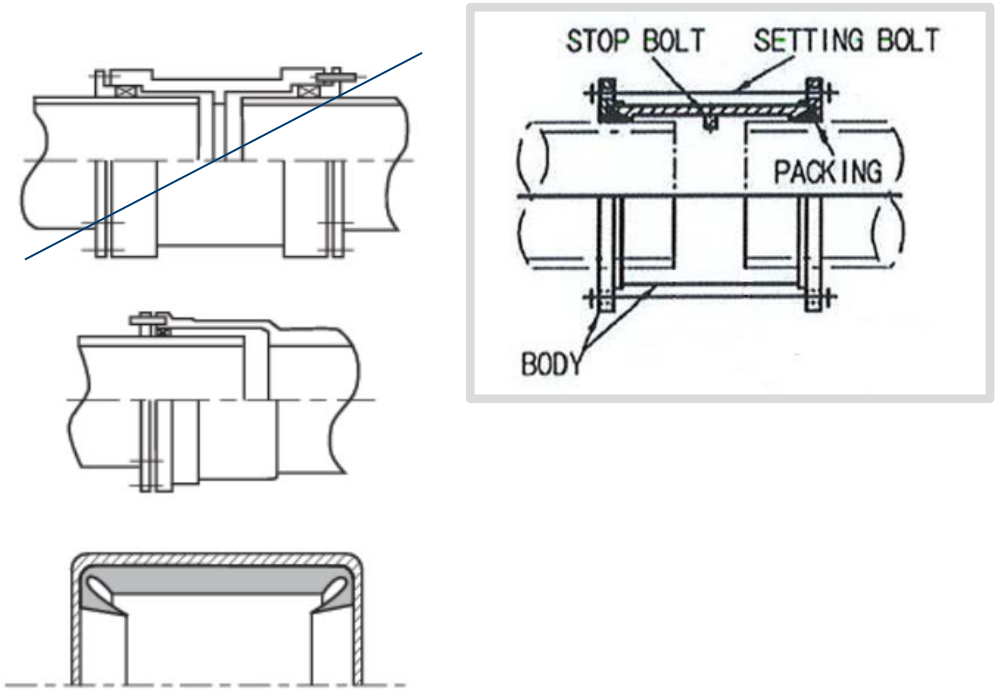
Machine Grooved Type	
Slip Type	

Figure 1.5.3 Examples of mechanical joints (Part 2) *(Part only shown)*

Table 1.5.6 Application of mechanical joints

Systems	~~Kind~~Type of connections		
	Pipe unions	Compression couplings ~~(5)~~	Slip-on joints
Flammable fluids (Flash point > 60°)			
Fuel oil lines *see* Notes 2 & 3	+	+	~~+~~2,~~3~~
Lubricating oil lines *see* Notes 2 & 3	+	+	~~+~~2,~~3~~
Hydraulic oil *see* Notes 2 & 3	+	+	~~+~~2,~~3~~
Sea-water			
Bilge lines *see* Note 1	+	+	~~+~~1
Water filled fire-extinguishing systems, e.g. sprinkler systems *see* Note 3	~~+~~	~~+~~	~~+~~
Non-water filled fire-extinguishing systems, e.g. foam, drencher systems *see* Note 3	~~+~~	~~+~~	~~+~~
Fire main ~~and water spray~~ (not permanently filled) *see* Note 3	+	+	~~+~~3
~~Foam system~~	~~+~~	~~+~~	~~+~~3
~~Sprinkler system~~	~~+~~	~~+~~	~~+~~3
Ballast system *see* Note 1	+	+	~~+~~1
Cooling water system *see* Note 1	+	+	~~+~~1
Tank cleaning services	+	+	+
Non-essential systems	+	+	+
Fresh water			
Cooling water system *see* Note 1	+	+	~~+~~1
Condensate return *see* Note 1	+	+	~~+~~1
Non-essential systems	+	+	+
Sanitary/Drains/Scuppers			
Deck drains (internal) *see* Note 4	+	+	~~+~~4
Sanitary drains	+	+	+
Scuppers and discharge (overboard)	+	+	-
Sounding/vent			
Water tanks/Sewage tanks/Dry spaces	+	+	+
Oil tanks (f.p.> 60°C) *see* Notes 2 & 3	+	+	~~+~~2,~~3~~
Miscellaneous			
Starting/Control air ~~(1)~~ *see* Note 1	+	+	-
Service air (non-essential)	+	+	+
Brine	+	+	+
CO_2 system *see* Note 1	+	+	-
Steam	+	+	~~-~~+ *see* Note 5

KEY

+ Application is allowed
- Application is not allowed

Note 1. ~~Inside machinery spaces of Category A~~ Mechanical joints that include any components which readily deteriorate in case of fire, are to be of an approved fire-resistant type when fitted in machinery spaces of category A. Mechanical couplings fitted on the 'bilge main' in machinery spaces of category A are to be of steel or equivalent material.~~ only approved fire resistant types.~~

Note 2. Mechanical joints that include any components which readily deteriorate in case of fire are ~~Not~~ not permitted inside machinery spaces of ~~C~~category A or accommodation spaces. Mechanical joints that include any components which readily deteriorate in case of fire that are of an approved fire-resistant type ~~May~~may be ~~accepted~~ fitted in other machinery spaces provided the joints are located in easily visible and accessible positions.

Note 3. ~~Approved fire resistant types~~ Mechanical joints that include any components which readily deteriorate in case of fire fitted on fuel oil lines are to be of an approved fire-resistant type. Mechanical joints that include any components which readily deteriorate in case of fire fitted on other systems are to be of an approved fire-resistant type except when fitted on open decks having little or no fire risk.

~~**Note** 4. Above freeboard deck only.~~

~~**Note** 5. If compression couplings include any components which are sensitive to heat, they are to be of approved fire resistant type as required for slip-on joints.~~

Note 4. Mechanical joints are only permitted above bulkhead deck of passenger ships and freeboard deck of cargo ships.

Note 5. *See Pt 15, Ch 1, 5.8 Other mechanical couplings 5.8.10*

5.8.2 Where the application of mechanical joints results in a reduction in pipe wall thickness due to the use of bite type rings or other structural elements, this is to be taken into account in determining the minimum wall thickness of the pipe to withstand the design pressure.

~~5.8.3 Construction of mechanical joints is to prevent the possibility of tightness failure affected by pressure pulsation, piping vibration, temperature variation and other similar adverse effects occurring during operation on board.~~

~~5.8.4~~ 5.8.3 Materials of mechanical joints are to be compatible with the piping material and internal and external media.

~~5.8.5~~ 5.8.4 Mechanical joints for pressure pipes are to be tested to a burst pressure of 4 times the design pressure. For design pressures above 200 bar the required burst pressure will be specially considered.

~~5.8.6 In general, mechanical joints are to be of fire-resistant type where required by *Table 1.5.6 Application of mechanical joints*.~~

~~5.8.7~~ 5.8.5 Mechanical joints, which in the event of damage could cause fire or flooding, are not to be used in piping sections directly connected to the ~~sea openings~~ ship's side below the bulkhead deck of passenger ships and freeboard deck of cargo ships or tanks containing flammable fluids.

~~5.8.8~~ 5.8.6 Mechanical joints are to be designed to withstand internal and external pressure as applicable and where used in suction lines are to be capable of operating under vacuum.

5.8.7 The number of mechanical joints in flammable fluid systems is to be kept to a minimum. In general, flanged joints are to conform to a recognised standard.

~~5.8.9~~ 5.8.8 Generally, slip-on joints are not to be used in pipelines in cargo holds, tanks, and other spaces which are not easily accessible. Application of these joints inside tanks may only be accepted where the medium conveyed is the same as that in the tanks.

~~5.8.10~~ 5.8.9 ~~Unrestrained slip-on joints are only to be used in cases where compensation of lateral pipe deformation is necessary.~~ Usage of slip type slip-on ~~these~~ joints as the main means of pipe connection is not permitted except for cases where compensation of axial pipe deformation is necessary.

5.8.10 Restrained slip-on joints are permitted in steam pipes with a design pressure of 10 bar or less on the weather decks of oil and chemical tankers to accommodate axial pipe movement, *see Pt 15, Ch 2, 2.2 Provision for expansion*.

~~5.8.11~~ 5.8.11 Mechanical joints are to be tested in accordance with the test requirements of LR's Type Approval Test Specification Number 2, as relevant to the service conditions and the intended application. The programme of testing is to be agreed with LR.

■ *Section 11*
Material certificates

11.1 Metallic materials

11.1.2 Materials for ~~Ferrous~~ metallic castings and forgings for Class I and II piping systems are to be produced at a works approved by Lloyd's Register (commonly referred to as 'LR') and are to be tested in accordance with the *Rules for the Manufacture, Testing and Certification of Materials* (commonly referred to as the Rules for Materials).

■ *Section 13*
~~Requirements for f~~Flexible hoses

13.3 Design requirements

13.3.1 Flexible hose assemblies are to be designed and constructed in accordance with recognised National or International ~~s~~Standards acceptable to LR.

13.3.2 Flexible hoses are to be complete with approved end fittings in accordance with manufacturer's specification. End connections which do not have flanges are to comply with *Pt 15, Ch 1, 5.8 Other mechanical couplings* as applicable and each type of hose/fitting combination is to be subject to prototype testing to the same standard as that required by the hose with particular reference to pressure and impulse tests.

13.3.3 Flexible hose assemblies intended for installation in piping systems where pressure pulses and/or high levels of vibration are expected to occur in service, are to be designed for the maximum expected impulse peak pressure and forces due to vibration. The tests required by *Pt 15, Ch 1, 13.4 Testing* are to take into consideration the maximum anticipated in-service pressures, vibration frequencies and forces due to installation.

13.3.4 Flexible hose assemblies constructed of non-metallic materials intended for installation in piping systems for flammable media, and sea-water systems where failure may result in flooding, are to be of fire-resistant type. Non-metallic flexible hoses used for sea water systems and flammable media, except fuel oil, installed on open decks having little or no fire risk are not required to be of fire-resistant type. Fire resistance is to be demonstrated by testing to ISO 15540 and ISO 15541.

13.3.5 Flexible hose assemblies are to be suitable for the intended location and application, taking into consideration ambient conditions, compatibility with fluids under working pressure and temperature conditions consistent with the manufacturer's instructions and any other applicable requirements in the Rules.

Part 15, Chapter 2
~~Hull~~ Ship Piping Systems

■ *Section 11*
Air, overflow and sounding pipes

11.4 Air pipe closing appliances

11.4.1 ~~Closing~~ The closing appliances fitted to tank air pipes, in accordance with *Pt 3, Ch 4, 12 Air and sounding pipes,* are to be of an automatic opening type which will allow the free passage of air or liquid to prevent the tanks being subjected to a pressure or vacuum greater than that for which they are designed, and prevent the free entry of water into the tanks~~, *see also Pt 3, Ch 4, 12.3 Closing appliances*~~.

11.4.2 Air pipe closing devices are to be type tested in accordance with the test requirements of LR's Type Approval Test Specification Number 2. The flow characteristic of the closing device is to be determined using water, *see Pt 15, Ch 2, 11.6 Size of air pipes 11.6.1* and *Pt 15, Ch 2, 11.6 Size of air pipes 11.6.2*.

11.4.4 Air pipe automatic closing devices shall be so designed that they will withstand both ambient conditions as indicated in *Pt 9, Ch 1, 4.4 Ambient reference conditions* and ~~*Pt 9, Ch 1, 4.4 Ambient operating conditions*~~ *Pt 9, Ch 1, 4.5 Ambient operating conditions* and designed working conditions, and be suitable for use at inclinations up to and including ± 40°.

11.4.11 The inner and the outer chambers of an automatic air pipe head are to be of a minimum thickness of 6 mm. Where side covers are provided, and their function is integral to providing functions of the closing device as outlined in *Pt 15, Ch 2, 11.4 Air pipe closing appliances 11.4.1*, they shall have a minimum wall thickness of 6 mm. If the air pipe head can meet the tightness test in LR's Type Approval Test Specification Number 2 without the side covers attached, then the side covers are not considered to be integral to the closing device, in which case a wall thickness less than 6 mm will be accepted.

11.4.15 Closures and seats made of non-metallic materials are to be compatible with the media intended to be carried in the tank and with sea-water, and suitable for operating at ambient temperatures between –25°C and 85°C.

Part 15, Chapter 3
Machinery Piping Systems

■ *Section 13*
Ballast water treatment system and installation

13.1 General

13.1.1 The requirements given in the Rules for Ships, *Pt 5, Ch 25 Ballast Water Treatment System and Installation* are to be complied with, as applicable.

Part 16, Chapter 2
Electrical Engineering

■ *Section 9*
Rotating machines

9.1 General requirements

9.1.2 The insulation systems of electrical rotating machines used for essential services are to be tested following the principles detailed in IEC 60505*, Evaluation and qualification of electrical insulations systems*, or an equivalent National Standard acceptable to LR.

Paragraphs 9.1.2 *to* 9.1.9 *have been renumbered* 9.1.3 *to* 9.1.10.

9.1.11 For the HV rotating machines used for essential services are to comply with the relevant requirements of *Pt 6, Ch 2, 9, Rotating machines* of the Rules and Regulations for the Classification of Ships.

Published by Lloyd's Register Group Limited
Registered office (Reg. no. 08126909)
71 Fenchurch Street, London, EC3M 4BS
United Kingdom